

Amendment Under 37 C.F.R. § 1.111  
Serial No.: 10/070,534  
SUGHRUE MION, PLLC Ref: Q68538

## **AMENDMENTS TO THE CLAIMS**

**This listing of claims will replace all prior versions and listings of claims in the application:**

### **LISTING OF CLAIMS:**

Claim 1 (currently amended):           A method for continuously heat treating a double tapered steel wire (S), characterized by comprising the steps of:

continuously detecting a diameter of said steel wire (S) in heat ~~treatments~~ treatment of said steel wire (S), wherein said steel wire (S) has ~~its~~ constant large-diameter straight portion (21, 24), a constant small-diameter portion (24) and a ~~disposed between its opposite tapered end portions (22, 23) disposed therebetween~~ in its longitudinal direction, ~~wherein said opposite end portions (22, 23) are tapered down to their outer reduced diameter ends;~~

controlling the amount of energy of induction heating supplied to said steel wire (S), wherein the amount of said energy is proportional to a wire diameter of said steel wire (S) having been detected;

~~whereby~~ so that said steel wire (S) is evenly ~~heat-treated~~ heated over the entire length of said steel wire (S); and

at least one of quenching and tempering said steel wire (S) in a manner such that the tensile strength of the small-diameter portion and the tensile strength of the large-diameter portion of said steel wire (S) are substantially equal;

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wherein said steel wire (S) substantially keeps its original shape unchanged throughout in its heat treatment.

Claim 2 (currently amended):          A double tapered steel wire (S) characterized by comprising:

a straight portion (21, 24) with a constant large-diameter;  
opposite tapered portions (22, 23) disposed adjacent to opposite ends of said straight ~~portion~~ portions (21, 24), wherein said tapered portions (22, 23) are tapered down to their reduced-diameter outer ends;

straight portions (24) with a constant small-diameter respectively disposed on opposite ends of said tapered portions;

~~wherein said steel wire (S) is heat treated using induction heating in a manner such that said steel wire (S) has its small diameter portions (24) be substantially equal to its large-diameter portion (21) in tensile strength~~ a diameter of said steel wire (S) is continuously detected, and the amount of energy of induction heating supplied to said steel wire (S) thus detected is proportional to said diameter of said steel wire (S), so that said steel wire (S) is evenly heated over the entire length of said steel wire (S), and then at least one of quenched and tempered in a manner such that the tensile strength of the small-diameter portions (24) is substantially equal to the tensile strength of the large-diameter portion (21);

wherein said steel wire (S) substantially keeps its original shape unchanged throughout its heat treatment.

Claim 3 (currently amended):           An apparatus for continuously heat treating a double tapered steel wire (S), wherein the steel wire (S) is provided with a constant large-diameter straight portion (21, 24), constant small-diameter straight portions (24) and a pair of opposite tapered portions (22, 23) respectively disposed between the large-diameter portion and the small-diameter portions adjacent to opposite ends of said straight portion (21, 24), wherein said tapered portions (22, 23) are tapered down to their reduced-diameter outer ends, the apparatus being characterized by comprising:

an induction heating means (4, 7) for continuously heating said steel wire (S);

a wire diameter detection means (3, 6) for continuously detecting a diameter of said steel wire (S); and

a control means (12) for controlling the amount of energy supplied to said induction heating means (4, 7) in a manner such that said steel wire (S) has its individual portions (21-24) heated to individual predetermined temperatures over the entire length of said steel wire (S), wherein the amount of said energy supplied to said induction heating means (4, 7) is proportional to a wire diameter of said steel wire (S) having been detected by said wire diameter detection means (3, 6);

wherein a diameter of said steel wire (S) is continuously detected by said wire diameter detection means (3, 6), and the amount of energy of induction heating supplied to said steel wire (S) thus detected is controlled by said control means (12) so as to be proportional to said diameter of said steel wire (S);

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whereby said steel wire (S) is evenly heated over the entire length of said steel wire (S), and then at least one of quenched and tempered in a manner such that the tensile strength of the small-diameter portions (24) is substantially equal to the tensile strength of the large-diameter portion (21);

wherein said steel wire (S) substantially keeps its original shape unchanged throughout in its heat treatment.

Claim 4 (original): The apparatus for continuously heat treating the double tapered steel wire (S) according to claim 3, characterized by further comprising a quenching means and a tempering means, wherein said quenching means and said tempering means are arranged in tandem to have said steel wire (S) be continuously subjected to a quenching process and a tempering process in this order.

Claim 5 (original): The apparatus for continuously heat treating the double tapered steel wire (S) according to claim 3 or 4, characterized in that said double tapered steel wire (S) is provided with:

additional large-diameter and small-diameter straight portions~~a plurality of straight~~  
~~portions (21, 24) each with a constant diameter; and, a plurality of~~ and corresponding additional  
tapered portions (22, 23) which are spaced alternately with said large and small-diameter straight  
portions (21, 24) in a longitudinal direction of said double tapered steel wire (S).